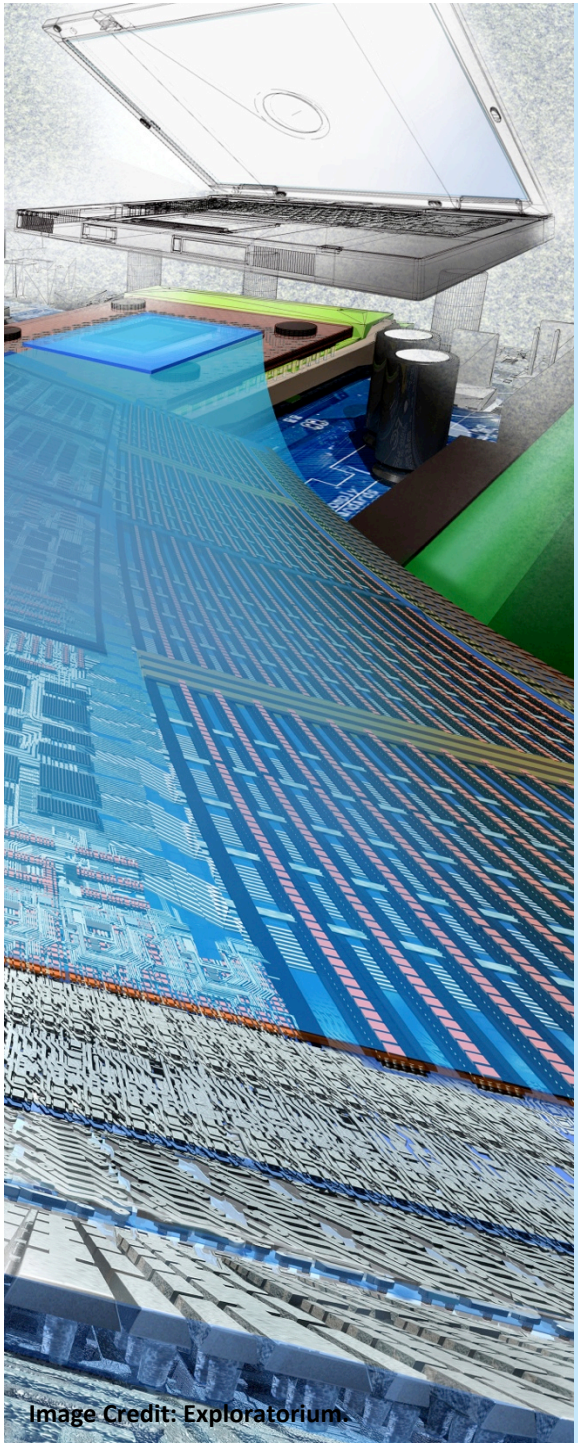


CISE Overview and Update

Farnam Jahanian
CISE Directorate
National Science Foundation

CISE Advisory Committee Meeting
May 10-11, 2012

Welcome new AC member!

Robert B. Schnabel
Dean, School of Informatics and Computing
Indiana University

Education and Workforce Development Subcommittee

Charge: Help CISE to coordinate and oversee activities in education, broadening participation, and workforce development, beginning with an emphasis on the CS 10K Project.

Membership

- *Teresa Dahlbert, Co-Chair*
- *Bobby Schnabel, Co-Chair*
- *David Dobkin*
- *Charles Isbell*
- *Ed Lazowska*
- *Ran Libeskind-Hadas*
- *Lucy Sanders*
- *Cameron Wilson*

Midscale Infrastructure Subcommittee

Charge: Help CISE to assess how well its current mid-scale infrastructure investment meets the needs of the community and advise CISE on future directions in similar investments.

Membership

- *Jim Kurose, Co-Chair*
- *Bruce Maggs, Co-Chair*
- *Paul Barford*
- *Fran Berman*
- *Steve Corbato'*
- *Jose' Fortes*
- *Ed Lazowska*
- *Jeff Mogul*
- *Dipankar Raychaudhuri*
- *Jennifer Rexford*

New CISE Staff

- *Jeffrey Anderson*, Program Assistant (STEP), HCC Cluster, IIS
- *Michael Branicky*, Expert, IIS
- *Prince Cummings,* Program Analyst, OAD
- *Jeremy Epstein*, SaTC, CNS
- *George Kesidis*, Expert, CNS
- *KaJuana Marshall,* Office Automation Clerk (STEP), OAD
- *Thyaga Nandagopal*, NeTS Cluster, CNS
- *Dominique Reed,* STEP Student, IIS
- *Philip Regalia*, CIF Cluster, CCF
- *Joanna Torovalles,* Office Automation Clerk (STEP), SHF cluster, CCF
- *Jasmine Young,* Program Analyst (SCEP), NRI Cluster, IIS
- *Ralph Wachter,* CSR Cluster, CNS

Program Officer Recruiting

- CISE currently has *4* openings:
  - Big Data: position expected to be filled by June
  - Advanced Computing Infrastructure (ACI): active search
  - Robotics, Architecture: launch this summer
- CISE anticipates that *6* IPA Program Officers will depart for their home institution within the next few months
  - Recruitments to replace underway: 2 new Program Officers will arrive this summer; interviews scheduled for other anticipated openings
- CISE also using experts to supplement staff
  - 3 new experts (including former Program Officers) assisting with panels and program management

2012 Waterman awardee Scott Aaronson

Image Credit: Scott Aaronson, MIT

- CAREER PI at MIT
- Theoretical computer scientist whose research spans computer science, physics, mathematics, and philosophy
- Studies ultimate limits on what can feasibly be computed in the physical world
- Blogs about Quantum Computing to a readership of thousands

2012 Waterman awardee Robert Wood

Image Credit: *Eliza Grinnell, Harvard School of Engineering and Applied Sciences*

- CAREER & Expedition PI at Harvard
- Interdisciplinary research at the growing interplay of computation, engineering, and biology
- Developed robotic flying insects, RoboBees, using an innovative fabrication technique inspired by a children's pop-up book

Budget and Program Update

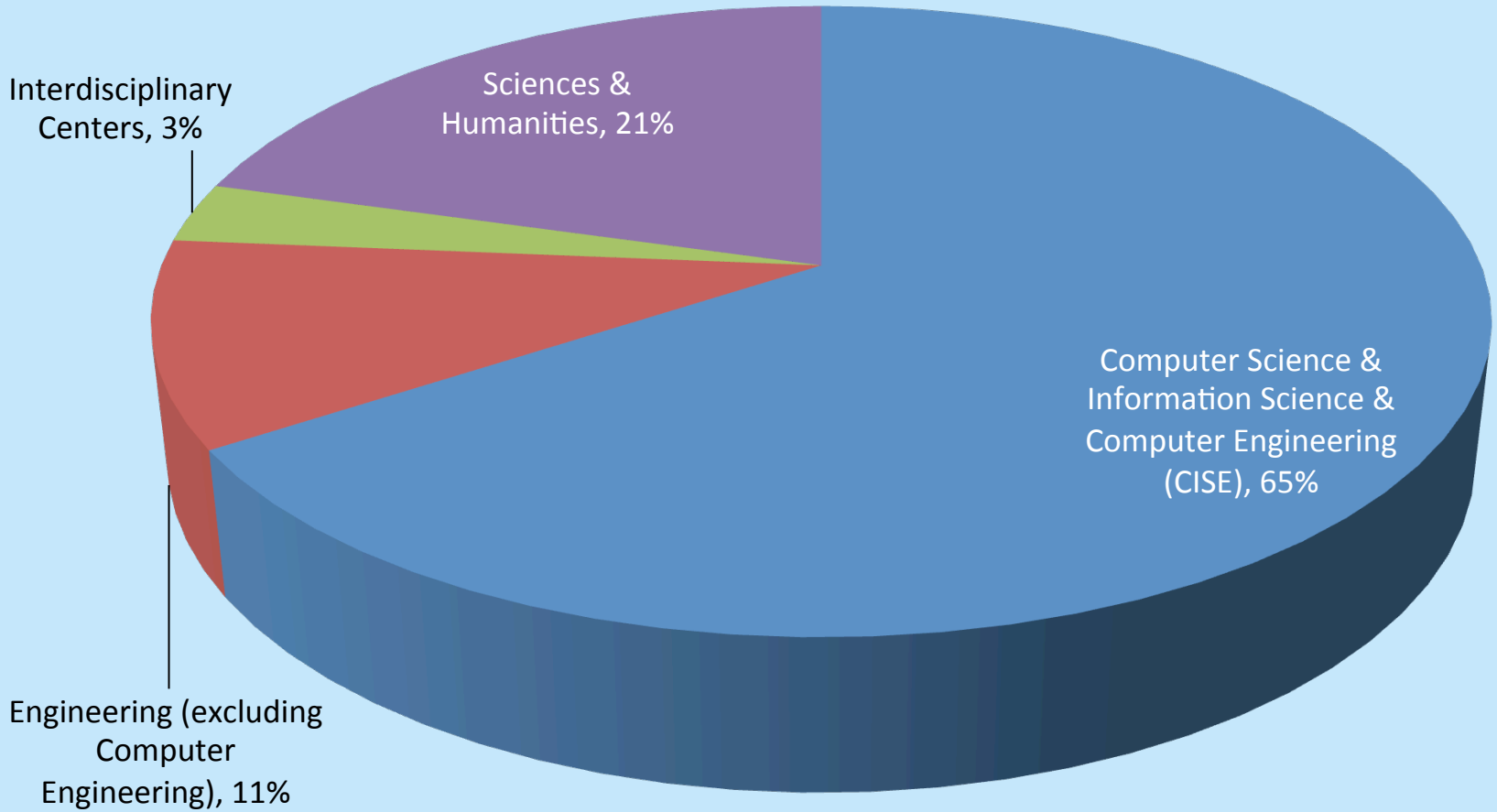
Snapshot of FY 2011 Activities

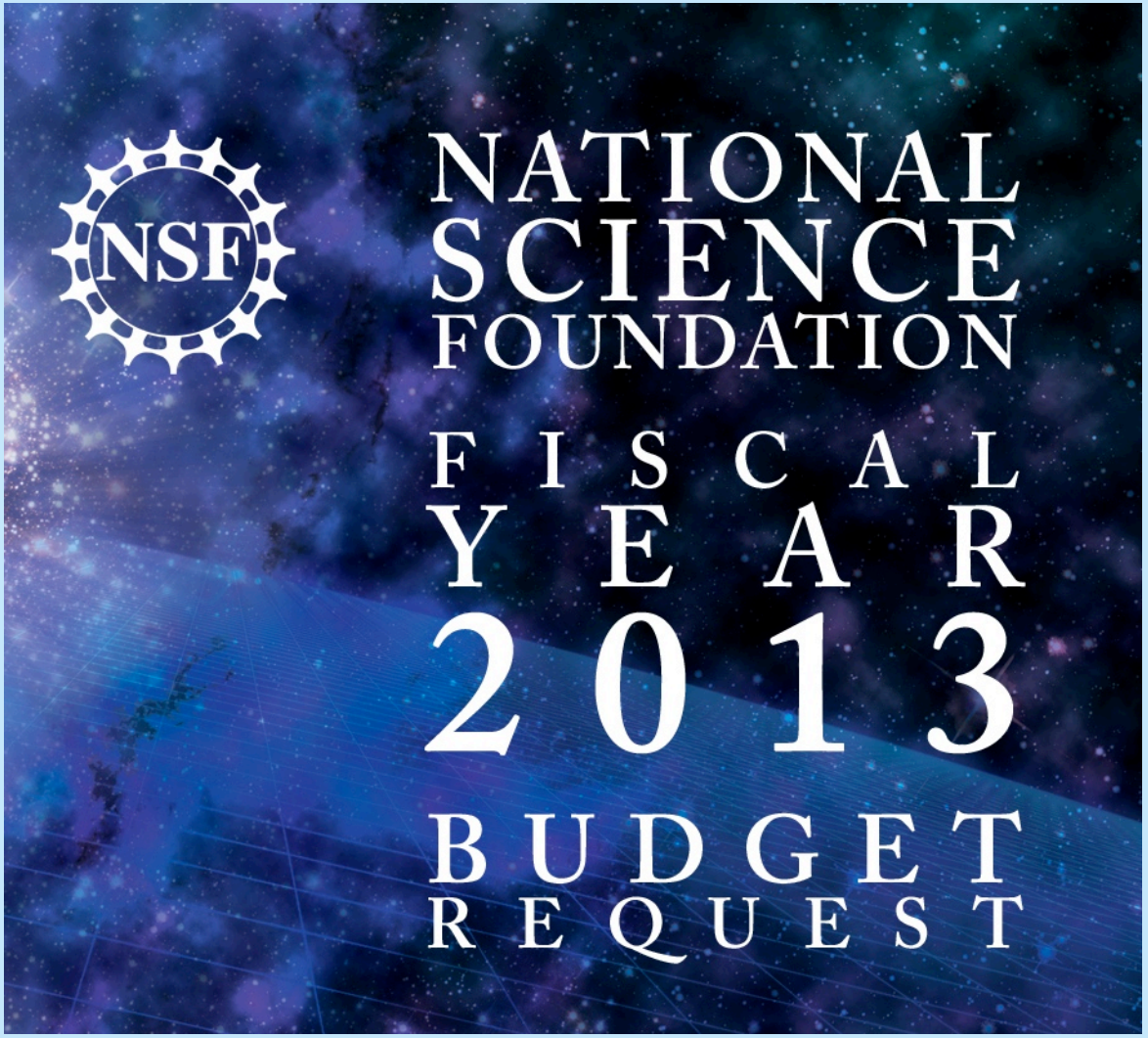
	CISE
Research Budget ($M)	$636M
Number of Proposals	5,973
Number of Awards	1,369
Success Rate	~20%
Average Award Size	$182K
Number of Panels Held	247
Number of People Supported	14,488

	CISE
Senior Researchers	6,812
Other Professionals	605
Postdoctoral Associates	371
Graduate Students	4,882
Undergraduate Students	1,818

Who is the CISE community?

PI and Co-PI Departments for FY 2011 Awards Funded by CISE




NSF
NATIONAL
SCIENCE
FOUNDATION
FISCAL
YEAR
2013
BUDGET
REQUEST

Context

- CISE is at the center of an ongoing **societal transformation** and will be for decades to come. Advances in computing, communication and information technology:
  - underpin our **economic prosperity and national security**
  - are a key driver of U.S. **competiveness** and sustainable **economic growth** in an increasingly global market
  - **accelerate the pace of discovery and innovation** in nearly all other fields of inquiry
  - are crucial to achieving our major **national and societal priorities**

CISE and National Priorities

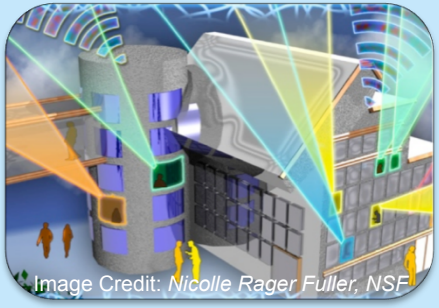


Image Credit: *Nicolle Rager Fuller, NSF*

Broadband & Universal Connectivity


Image Credits: *Texas A&M University*

Emergency Response & Disaster Resiliency

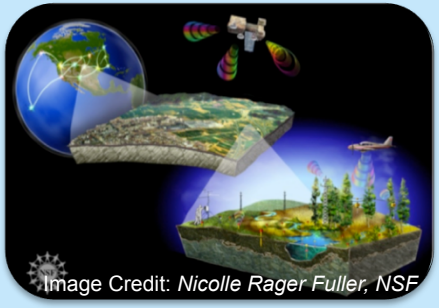


Image Credit: *Nicolle Rager Fuller, NSF*

Environment & Sustainability

Health & Wellbeing


Image Credit: *MicroStrain, Inc.*

Manufacturing, Robotics, & Smart Systems


Image Credit: *ThinkStock*

Secure Cyberspace


Image Credit: *Cisco, Inc.*

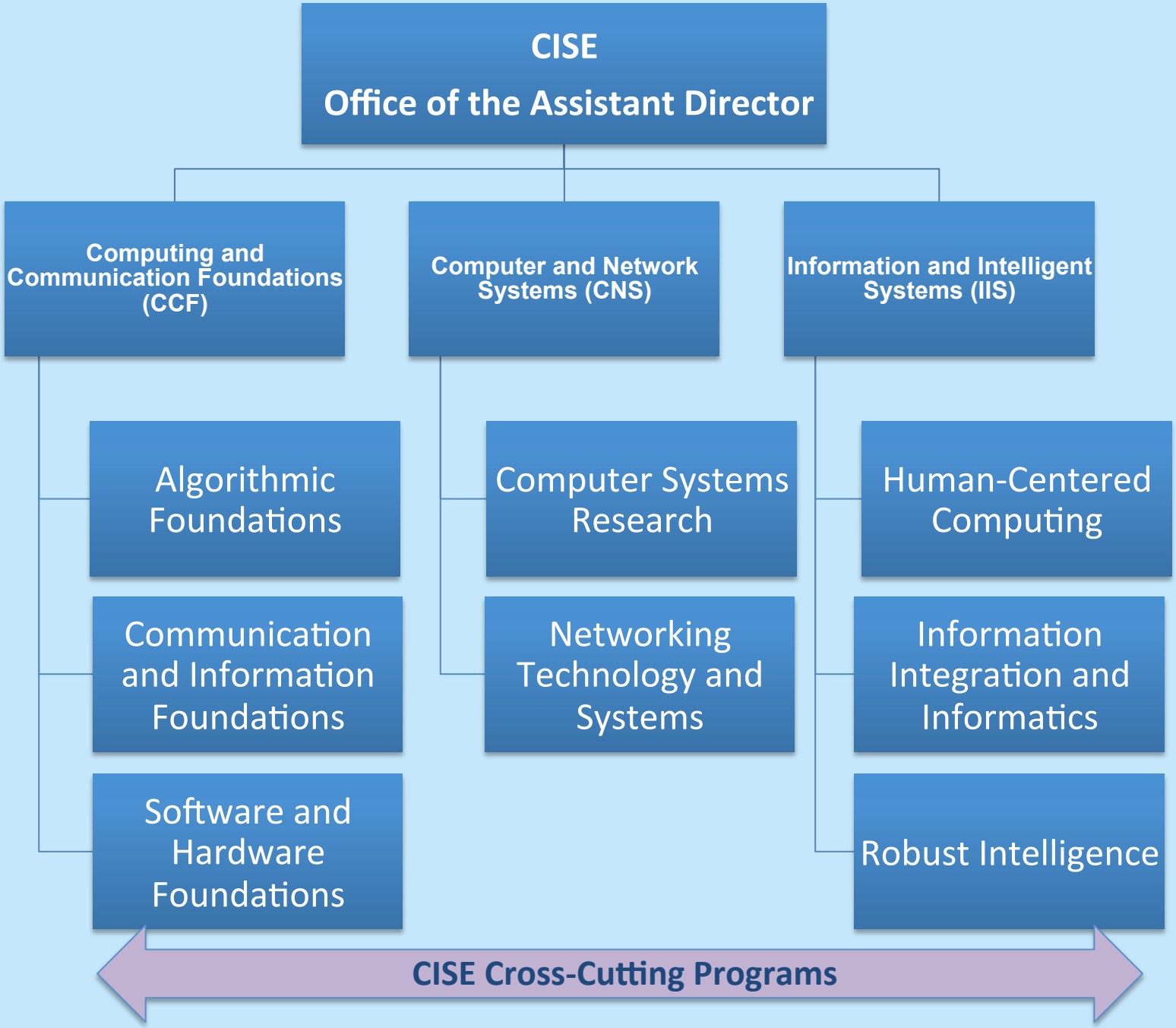
Transportation & Energy


Image Credit: *Georgia Computes! Georgia Tech*

Education and Workforce Development

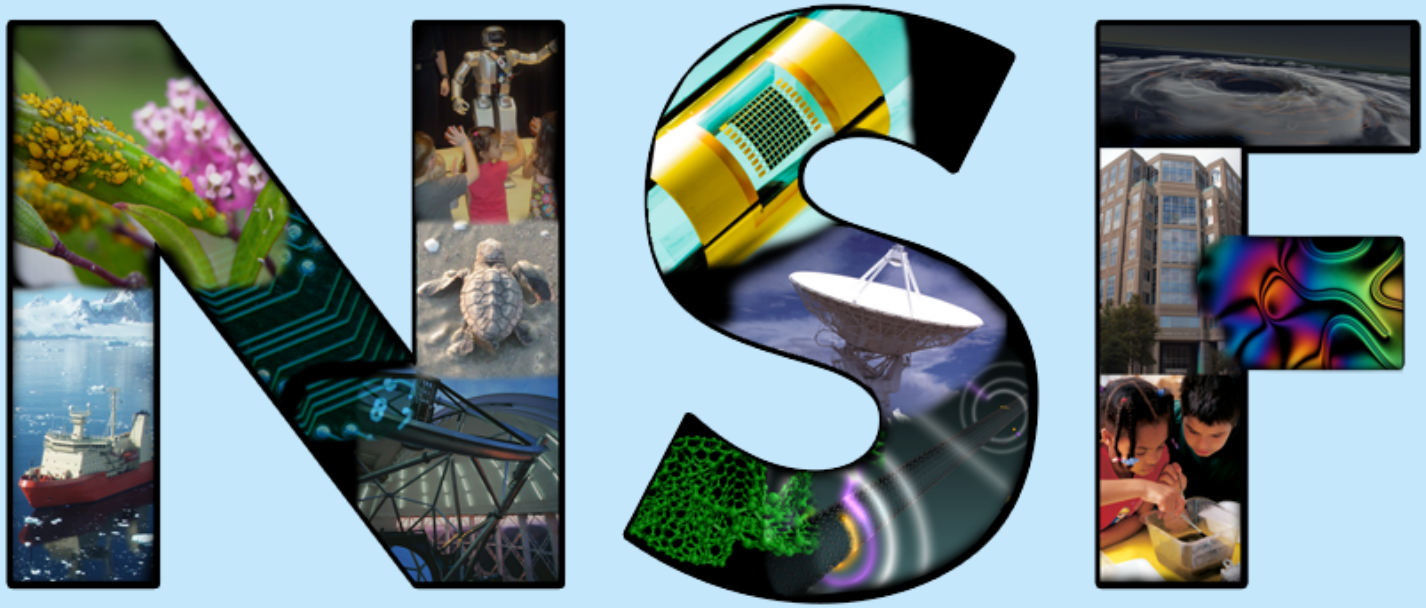
FY 2013 Budget Request

- **NSF**
  - FY 2013 Budget Request $7,373.10 M
  - Increase over FY 2012 enacted $340M or 4.8%
- **CISE**
  - FY 2013 Budget Request $709.72 M
  - Increase over FY 2012 estimate $56.13M or 8.6%
- CISE FY 2013 request is shaped by investments in OneNSF in addition to investments in core research, education, and infrastructure programs


CISE
Office of the Assistant Director
Computing and Communication Foundations (CCF)
Computer and Network Systems (CNS)
Information and Intelligent Systems (IIS)
Algorithmic Foundations
Communication and Information Foundations
Software and Hardware Foundations
Computer Systems Research
Networking Technology and Systems
Human-Centered Computing
Information Integration and Informatics
Robust Intelligence
CISE Cross-Cutting Programs

Strong Commitment to the Core

CISE continues to cast a wide net and let the best ideas surface, rather than pursuing a prescriptive research agenda. It engages the research community in developing new fundamental ideas, which are then evaluated by the best researchers through the merit review process. This process, which supports the vast majority of unclassified computing research in the United States, has led to innovative and transformative scientific results with enormous economic impact and societal benefits.

One 

OneNSF Initiatives

- Cyber-Enabled Materials, Manufacturing, and Smart Systems (CEMMSS)
- Secure and Trustworthy Cyberspace (SaTC)
- Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21)
- Science, Engineering, and Education for Sustainability (SEES)
- Expeditions in Education (E^2)
- Innovation Corps (I-Corps)
- Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE)

Cyber-Enabled Materials, Manufacturing, and Smart Systems (CEMMSS)

Accelerating advances in 21st century smart engineered systems

- Creating smart systems that sense, respond, and adapt to the environment
- In partnership with BIO, ENG, MPS, and OCI, CISE aims to:
  - Establish scientific basis for engineered systems interdependent with physical world and social systems
  - Synthesize multi-disciplinary knowledge to model and simulate systems in full complexity and dynamics
  - Develop a smart systems technology framework
- CISE focus in CEMMSS includes Advanced Manufacturing, **Cyber-Physical Systems (CPS)**, and **National Robotics Initiative (NRI)**

Cyber-Physical Systems

Deeply integrating computation, communication, and control into physical systems

- Pervasive computation, sensing and control
- Networked at multi- and extreme scales
- Dynamically reorganizing and reconfiguring
- High degrees of automation
- Dependable operation with high assurance of reliability, safety, security and usability

Transportation

Manufacturing and Industrial Automation

Energy

Healthcare and Biomedical

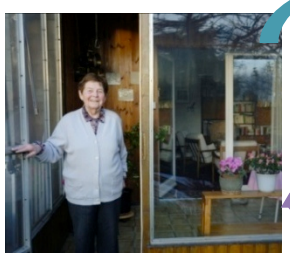
Critical Infrastructure

Cross-Directorate Program: CISE & ENG

Smart Systems: Sensing, Reasoning, and Decision

Environment Sensing



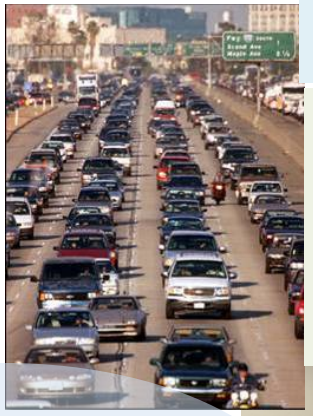

Percepts (sensors)

Agent (Reasoning)

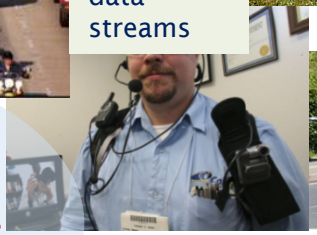
Actions (controllers)

Pervasive Computing

Emergency Response



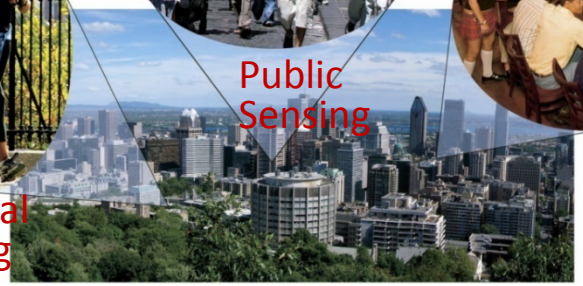
Situation Awareness : Humans as sensors feed multi-modal data streams


People-Centric Sensing

Social



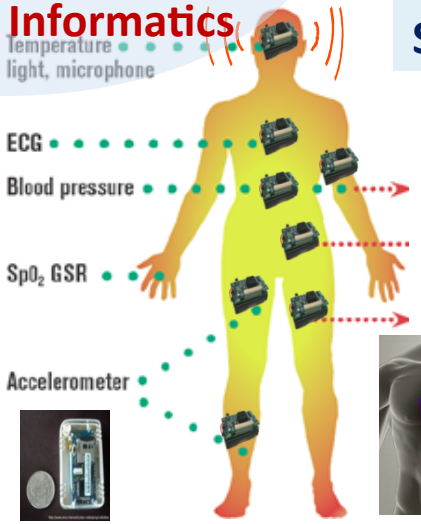



Public Sensing

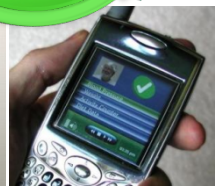
Personal Sensing

Social Sensing

Informatics



Smart Hearth Care

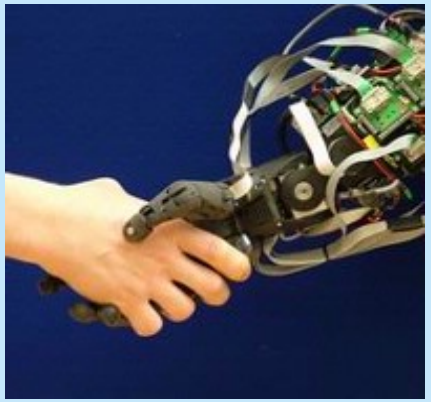
Source: Sajal Das, Keith Marzullo

Credit: Image courtesy of University of Florida

National Robotics Initiative (NRI)

Developing the next generation of collaborative robots to enhance personal safety, health, and productivity

A nationally concerted cross-agency program to provide U.S. leadership in science and engineering research and education aimed at the development and use of cooperative robots that work alongside people across many sectors.



Credit: *Bristol Robotics Lab*

Research Thrusts

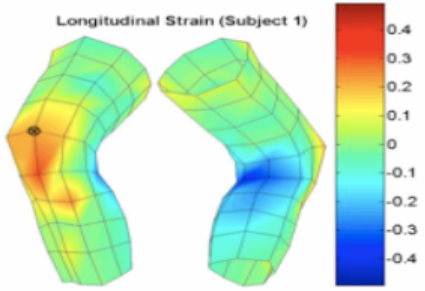
- **Fundamental research in robotics science & engineering**
- **Understanding the long term social, behavioral, and economic implications across all areas of human activity**
- **Use of robotics to facilitate and motivate STEM learning across the K-16 continuum**

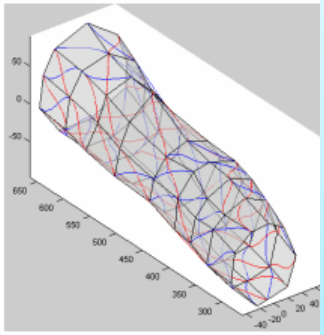
Cross-Directorate Program: CISE, EHR, ENG, and SBE

Multi-agency Commitment: NSF, NASA, NIH, USDA

NSF CPS Awards Span Many Sectors

Assistive Medical Technologies: Programmable second skin senses and re-educates injured nervous systems. (Eugene Goldfield, Harvard Medical School)





Credit: Wyss Institute, Harvard University

Environmental Sensing: Modeling and software allow actuated sensing in dynamic environments, such as rivers. (Jonathan Sprinkle, U. Arizona; Sonia Martinez, UCSD; Alex Bayen, UC Berkeley)

Credit: Jonathan Beard

Autonomous Vehicles: Development of precision and real-time sensors, smart algorithms, and verification tools enables self-driving cars. (Ragunathan "Raj" Rajkumar, CMU, et al.)

Image Credit: *PaulStamatiou.com*

Secure and Trustworthy Cyberspace (SaTC)

Securing our Nation's cyberspace

- Cross-directorate partnership among CISE, EHR, ENG, MPS, OCI, and SBE to build a cybersecure society and provide a strong competitive edge in the Nation's ability to produce high-quality digital systems and a well-trained cybersecurity workforce
- Supports the Comprehensive National Cybersecurity Initiative (CNCI)
- Aligns with the President's *Strategic Plan for the Federal Cybersecurity Research and Development Program* (released Dec 2011)

Image Credit: *ThinkStock*

Secure and Trustworthy Cyberspace (SaTC)

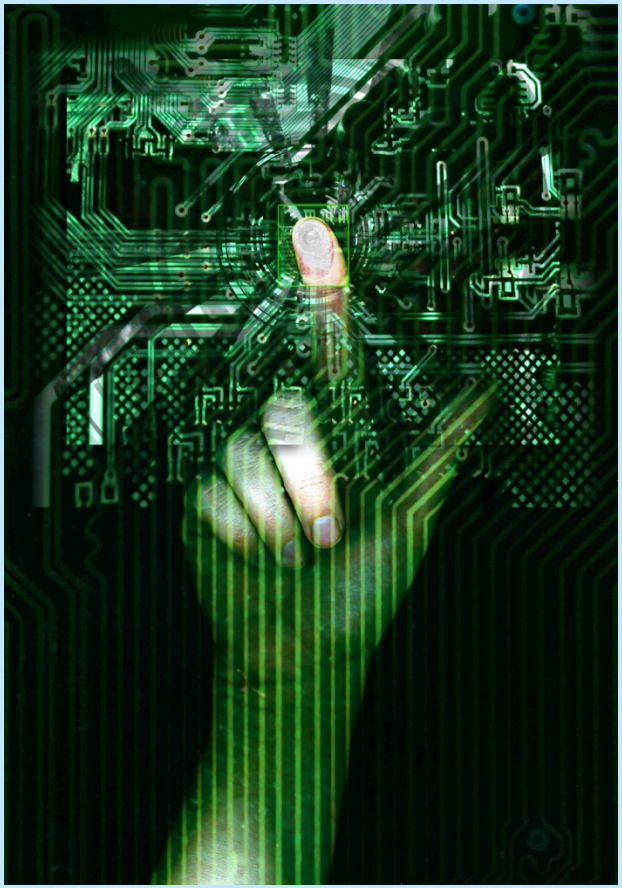


Image Credit: *ThinkStock*

- **SaTC solicitation** addresses cybersecurity from one or more of three perspectives:
  - Trustworthy Computing Systems
  - Social, Behavioral and Economics
  - Transition to Practice

- **Scholarship for Service (SFS)** will increase the number of qualified students entering the fields of information assurance and cybersecurity
  - Of over 1500 funded through the program, over 1100 have been placed in Federal agencies

Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21)

Accelerating the progress of scientific discovery and innovation

- Cross NSF framework to provide a comprehensive, integrated, sustainable, and secure cyberinfrastructure to accelerate research and education and new functional capabilities in computational and data-intensive science and engineering
- CISE focus in CIF21 includes **Advanced Computing Infrastructure** and **Big Data**

NSF's Advanced Computing Infrastructure

Advanced Computing Infrastructure (ACI) is a coordinated NSF-wide strategy that strives to provide a balanced portfolio of high-end computing capabilities to science and engineering research and education communities.

ACI includes **foundational research** to fully exploit highly parallel computer architectures and compilers, applications research through innovations in algorithms, statistical modeling, and data analytics, software development, and data intensive science.

While supercomputers remain a key generator of data, the exponential increase in data from a growing, distributed set of diverse scientific instruments and sensor networks requires **a new and qualitatively different approach** to data storage, stewardship, management, cyber-security, distribution, and access and education.

CIF21 Framework: Advanced Computational Infrastructure (ACI)

Ensuring access to cyberinfrastructure to tackle complex problems and issues

- **CISE focus on Advancing Limits of Computation**:
  - Foundational research to fully exploit parallelism and concurrency through innovations in computational models and languages, mathematics and statistics, algorithms, compilers, operating and run-time systems, and software and analytic tools
  - Distributed systems at scale – multi-core and multi-machine systems – with computational models and new programming paradigms for distributed approaches, such as cloud and cluster computing

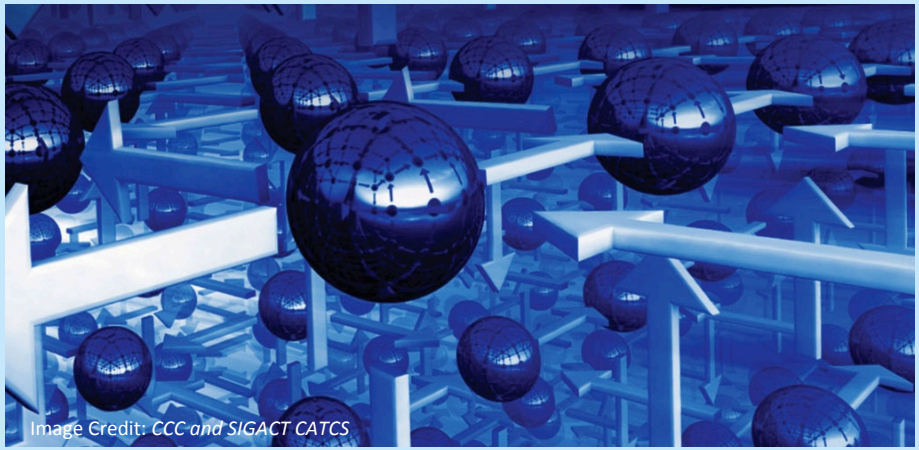
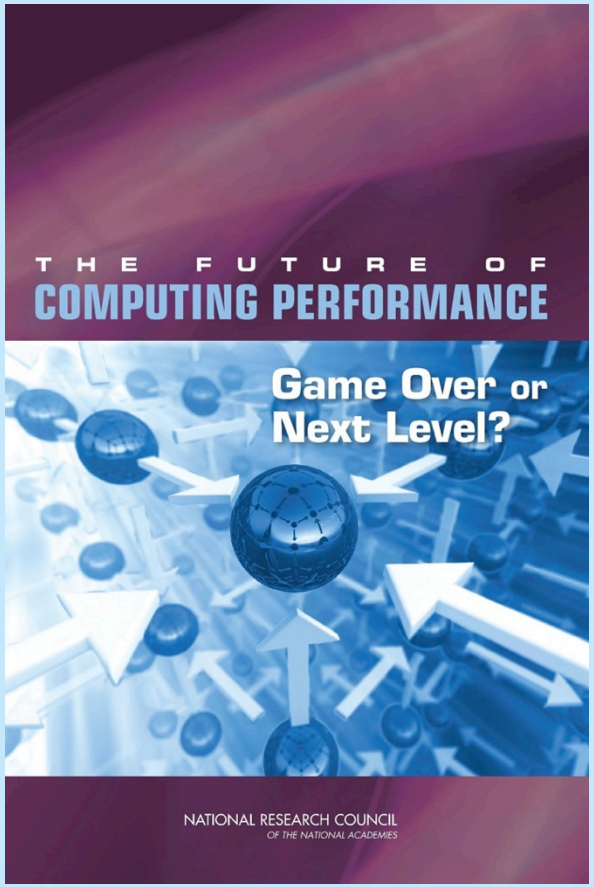


Image Credit: *CCC and SIGACT CATCS*

Computing Research Agenda Centered on Parallelism and Concurrency

- **Computational models** to enable new ways of "thinking parallel"
- **Programming languages** to enable effective expression of parallelism at every scale
- **Algorithms** to better exploit parallelism and concurrency
- **Software systems** capable of handling both small and extreme-scale data systems and data analytics
- **Software Architectures** to enable resilient computation at scale
- **Parallel architectures** to achieve energy- and power-efficiency, resilient and secure systems, possibly customized for applications
- **Techniques to map legacy applications onto parallel architectures**
- **Rethinking the canonical computing "stack"** applications, programming language, compiler, run time systems, OS, architecture



CIF21 Framework: Core Techniques and Technologies for Advancing Big Data Science & Engineering (BIG DATA)

Foundational research to extract knowledge from data

- Advance **big data** science and engineering through support of foundational research for managing, analyzing, visualizing, and extracting useful information from large, diverse, distributed, and heterogeneous data sets

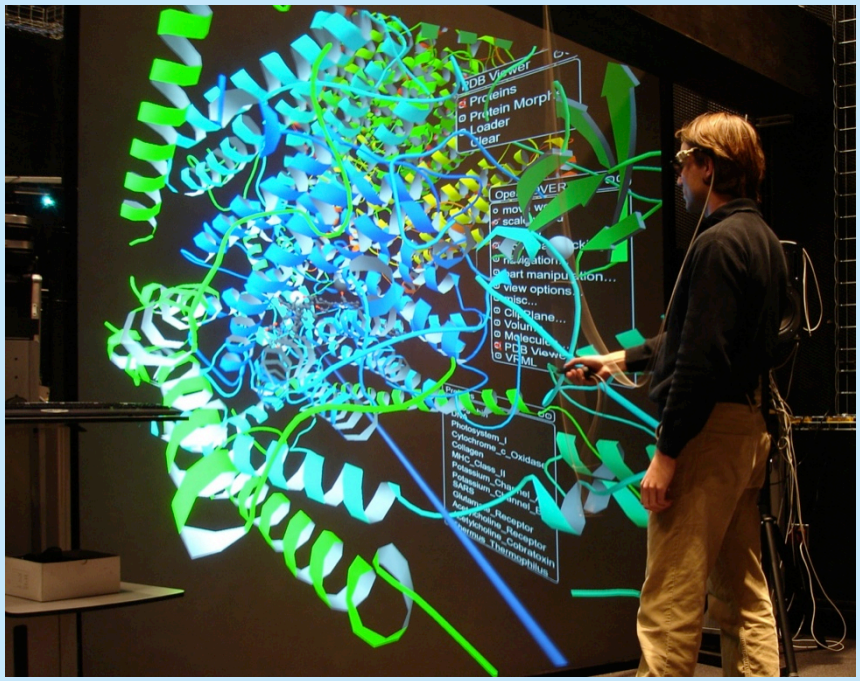


Image Credit: *Jurgen Schulze, Calit2, UC-San Diego*

Cross-Directorate Program: NSF Wide

Multi-agency Commitment: NSF and NIH

BIG DATA Research Thrusts

Collection, Storage, and Management of "Big Data"

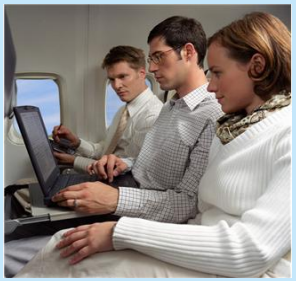
- Data representation, storage, and retrieval
- New parallel data architectures, including clouds
- Data management policies, including privacy and access
- Communication and storage devices with extreme capacities
- Sustainable economic models for access and preservation

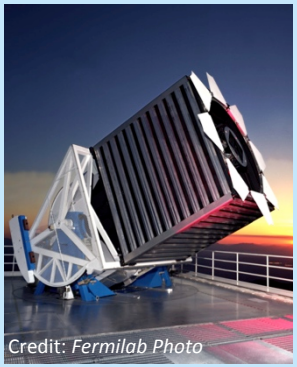
Data Analytics

- Computational, mathematical, statistical, and algorithmic techniques for modeling high dimensional data
- Learning, inference, prediction, and knowledge discovery for large volumes of dynamic data sets
- Data mining to enable automated hypothesis generation, event correlation, and anomaly detection
- Information infusion of multiple data sources

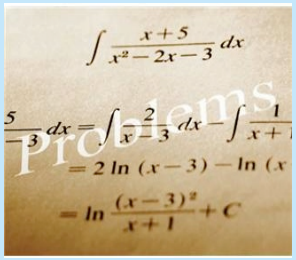
Data Sharing and Collaboration

- Tools for distant data sharing, real time visualization, and software reuse of complex data sets
- Cross disciplinary information and knowledge sharing
- Remote operation and real time access to distant data sources and instruments





Credit: *Fermilab Photo*



Big Data Launch

- Launched by White House OSTP on March 29, 2012 at AAAS

- Federal Announcements:
  - NSF – Subra Suresh
  - NIH – Francis Collins
  - USGS – Marcia McNutt
  - DoD – Zach Lemnios
  - DARPA Ken Gabriel
  - DOE – William Brinkman

- Panel Discussion:
  - Moderator - Steve Lohr, *New York Times*
  - Daphne Koller, Stanford University
  - James Manyika, McKinsey & Company
  - Lucila Ohno-Machado, UC San Diego
  - Alex Szalay, Johns Hopkins University

Image Credit: *National Science Foundation*

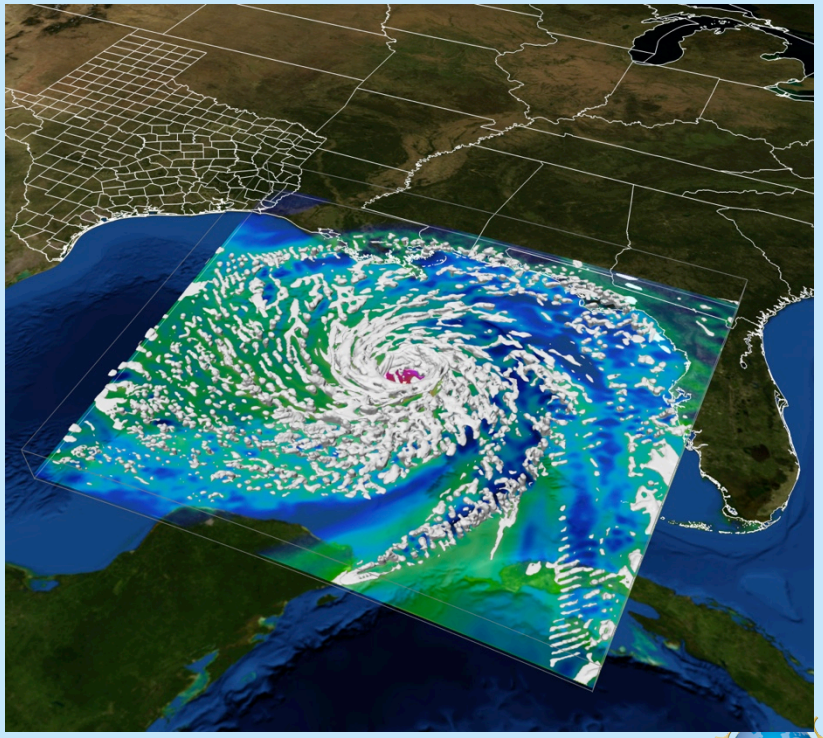


Image Credit: *Fuqing Zhang and Yonghui Weng, Pennsylvania State University; Frank Marks, NOAA; Gregory P. Johnson, Romy Schneider, John Cazes, Karl Schulz, Bill Barth, The University of Texas at Austin*

More information available at:
http://nsf.gov/news/news_summ.jsp?org=CISE&cntn_id=123607&preview=false

Extracting Knowledge from Data

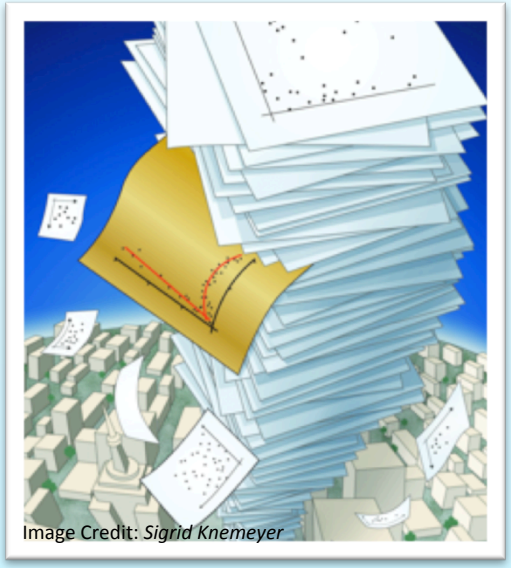
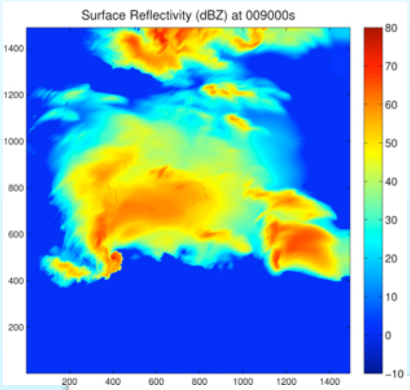


Image Credit: *Sigrid Knemeyer*

New Tool for Extracting Knowledge from Large Data Sets: A new statistical tool, part of a suite called MINE, can tease out multiple patterns hidden in health information from around the globe, statistics amassed from major league baseball, data on bacterial biodiversity, and much more. (Michael Mitzenmacher, Harvard with researchers from the Broad Institute)



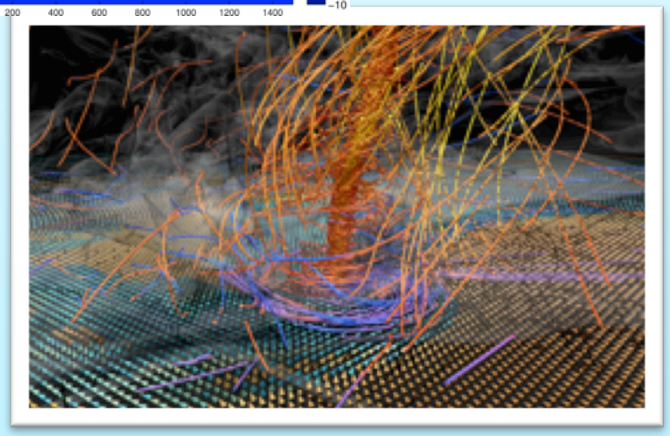


Image Credits: *Amy McGovern, School of Computer Science, University of Oklahoma (top) and Bob Wilhelmson, NCSA and the University of Illinois at Urbana-Champaign; Lou Wicker, National Oceanic and Atmospheric Administration's National Severe Storms Laboratory; Matt Gilmore and Lee Cronce, University of Illinois atmospheric science department. Visualization by Donna Cox, Robert Patterson, Stuart Levy, Matt Hall and Alex Betts, NCSA (bottom)*

Forecasting Tornadoes:
Parallel computing, data mining, and meteorology are being used to determine tornado formation and more reliable tornado forecasting. (Amy McGovern and Kevin Droegemeier, University of Oklahoma)

Science, Engineering, and Education for Sustainability (SEES)

Informing the societal actions needed for environmental and economic sustainability and sustainable human well-being

Multiple roles for computer science:

Monitoring: Scalable sensing & data collection	***Data:*** Storage, retrieval, analysis, visualization, and understanding	***Scalability:*** Parallelization, cloud computing, multi-level modeling, software engineering	***Addressing Complexity:*** Machine learning, autonomous & human assisted control	***Behavior Modeling & Change:*** Game theory, social networking

OneNSF

Role of Information Science & Engineering in Sustainability (RISES)

Cyber-enabled Sustainability

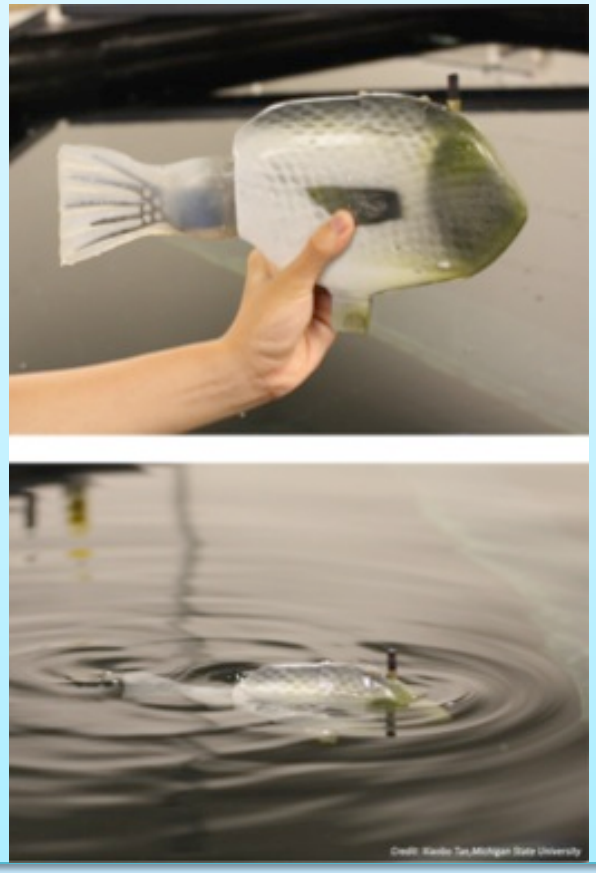
- Infrastructures, systems, and activities needed to advance sustainability in all fields require **sensors, computing and communications**
- Many of the complex problems arising in sustainability research need advances in the **computing and communication foundations and systems**

Green Computing

- **Computing technologies itself need to be sustainable,** including hardware, software, and energy storage and distribution
- Computation and communication must minimize its own **carbon footprint, materials use, and other environmental impacts** while still being cost-efficient, usable, and easily adoptable

Cyber-enabled Sustainability & “Green” Computing

Monitoring Aquatic Environments: Sensors in autonomous robotic fish monitor real-time movement and quality of water in lakes at the Kellogg Biological Station. (Xiabo Tan, Michigan State University)



New Approach to Power Distribution in Mobile Devices: Reduces battery usage by up to 20% and may revolutionize handset design. (David Brooks, Harvard)

Image permissions pending

Innovation Corps (I-Corps)

Accelerating innovations from the laboratory to the market

OneNSF

CISE Cross-Cutting Programs

- Expeditions in Computing
- Computing Education for the 21st Century (CE21)
- Smart Health and Wellbeing
- Enhancing Access to the Radio Spectrum (EARS)
- Mid-scale Research Infrastructure (GENI and US Ignite)

Expeditions-in-Computing

Exploring scientific frontiers that promise transformative innovations in computing

- $10M total per project ($2M/year per award for 5 years)
- 14 new to date

Beyond Moore's Law

- ***Variability-aware Software for Efficient Computing with Nanoscale Devices*, UCSD, UCLA, UIUC, Stanford, Michigan, 2010**
- ***Customizable Domain-Specific Computing*, UCLA, UCSB, Rice, Ohio State, 2009**
- ***The Molecular Programming Project*, CalTech, U Washington, 2008**

Sustainability & Environment

- ***Understanding Climate Change: A Data Driven Approach* – Minnesota, Northwestern, NC State, NC A&T State, 2010**
- ***Computational Sustainability: Computational Methods for a Sustainable Environment, Economy, and Society* – Cornell, Oregon State, Bowdoin, 2008**

Wireless & Internet

- ***Open Programmable Mobile Internet 2020,* Stanford, 2008**

Healthcare & Wellbeing

- ***Computational Behavioral Science: Modeling, Analysis, and Visualization of Social and Communicative Behavior,* Georgia Tech, MIT, Boston U, UIUC, USC, *Carnegie Mellon, 2010***
- ***Socially Assistive Robots, Yale, USC, MIT, Stanford, Willow Garage, 2011***

Robotics

- ***RoboBees: A Convergence of Body, Brain and Colony – Harvard, Northeastern, 2009***
- ***An Expedition in Computing for Compiling Printable Programmable Machines, MIT, U Penn, Harvard, 2011***

Limits of Computation

- ***Understanding, Coping with, and Benefiting from Intractability* – Princeton, Rutgers, NYU, Institute for Advanced Study, 2008**

Formal Modeling and Verification

- ***Next-Generation Model Checking and Abstract Interpretation with a Focus on Embedded Control and Systems Biology, Carnegie Mellon, Stony Brook, NYU, UMD, Pitt, Lehman College, JPL, 2009***
- ***Expeditions in Computer Augmented Program Engineering, U Penn, UC Berkeley, UMD, Rice, Cornell, U of Michigan, U of Illinois-UC, UCLA, MIT, 2011***

Big Data

- ***Algorithms, Machines, and People, UC Berkeley, UC San Francisco, 2011***
- ***Understanding Climate Change: A Data Driven Approach* – Minnesota, Northwestern, NC State, NC A&T State, 2010**

2012 Expeditions-in-Computing Awards

Expeditions in Computer Augmented Program Engineering

U Penn, UC Berkeley, UMD, Rice, Cornell, U of Michigan, U of Illinois-UC, UCLA, MIT

- Automation of software development process with programmer in the loop for correct and error free software

Algorithms, Machines, and People

UC Berkeley, UC San Francisco

- Large scale data analysis by integrating algorithms/machine-leaning, systems and people

An Expedition in Computing for Compiling Printable Programmable Machines

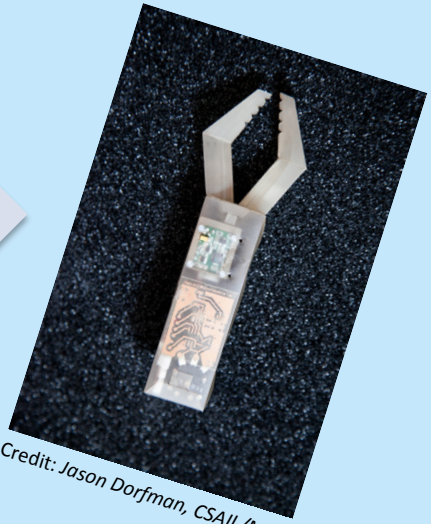
MIT, U Penn, Harvard

- End-to-end system for creating robots without the need for human intervention as the robot is created with programmable smart material

Socially Assistive Robots

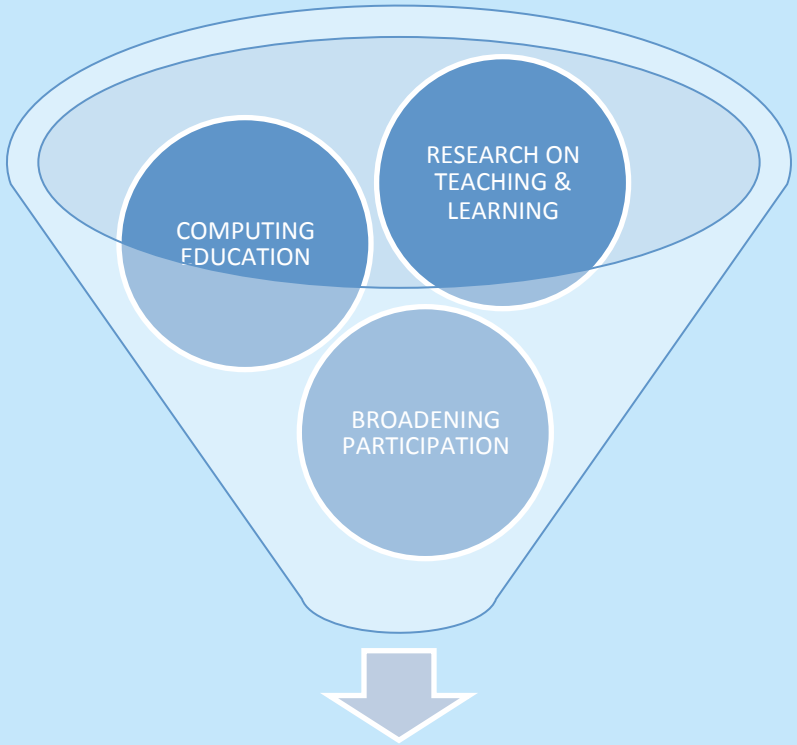
Yale, USC, MIT, Stanford, Willow Garage

- Robots that assist in teaching social, emotional and cognitive skills to children with needs; Move the state-of-the-art in human-robot interaction field from short-term interaction to long-term interaction that are adaptive, engaging, and effective.



Credit: Jason Dorfman, CSAIL/MIT

Computing Education for the 21st Century (CE21)



Goals:

- Increase number and diversity of K-14 students and teachers who develop computational competencies
- Increase number of postsecondary students who have background to pursue degrees in computing and computationally-intensive fields
- Build a research base for computing education

✧ Builds collaborations between CISE and EHR PIs

✧ Expects to catalyze the CS 10K Project

Cross Directorate Program: CISE, EHR, OCI

CS 10K Project

Transforming high school computing

Goal:

Get engaging, rigorous curricula into computing courses in 10,000 high schools, taught by 10,000 well-prepared teachers by 2016

- ✧ New preAP course, *Exploring Computer Science (ECS)*
- ✧ New (proposed) AP Course, *CS Principles*
- ✧ Develops scalable models, curricula and materials for professional development for teachers
- ✧ Fosters the growth of national community and partnerships needed to scale to 10,000 teachers & schools

Expeditions in Education (E^2)

Integrating, leveraging, and expanding STEM education

- Integrate, leverage, and expand STEM education research and development to improve learning in science & engineering disciplines and capitalize on the scientific assets across NSF to bring engaging new science content, knowledge and real-world applications to more learners
- Three focus areas:
  - Transforming Undergraduate STEM Learning through Science and Engineering
  - Learning and Understanding Sustainability
  - **Cyberlearning, Data, and Observations for STEM Education**

Cyberlearning: Transforming Education

Improving learning by integrating emerging technologies with knowledge from research about how people learn

Goals:

- Understand how people learn in technology rich environments
- Design and study ways in which innovative technologies and tools can promote learning and support assessment
- Prototype new technologies and integrate them into learning environments

DO-IT Center, University of Washington, Seattle

Cross-Directorate Program: CISE, EHR, OCI, SBE

Cyberlearning

Image permissions pending

Social Robots as Mechanisms for Language Instruction, Interaction, and Evaluation in Pre-School Children (David DeSteno, Northeastern; Cynthia Breazeal, MIT; Paul Harris, Harvard)

Image permissions pending

Exploring augmented reality to improve learning by deaf children in planetariums (Michael Jones, Brigham Young)

Image permissions pending

Geogames: A Virtual Simulation Workbench for Teaching and Learning through a Real-World Spatial Perspective (Karl Ola Ahlqvist, Ohio State)

Smart Health & Wellbeing

Transforming healthcare knowledge, delivery, and quality of life through IT

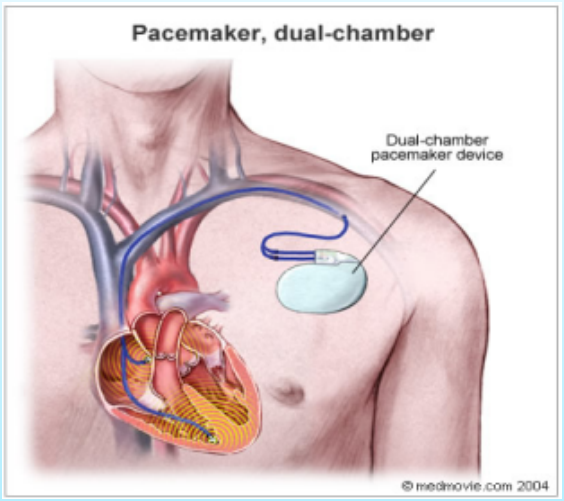
Paradigm Shift: transforming healthcare from reactive and hospital-centered to preventive, proactive, evidence-based, person-centered and focused on wellbeing rather than disease.

Research Thrusts

Digital Health Information Infrastructure	Data to Knowledge to Decision	Empowered Individuals	Sensors, Devices, and Robotics
Informatics and Infrastructure	*Reasoning under uncertainty*	*Energized, enabled, educated*	*Sensor-based actuation*

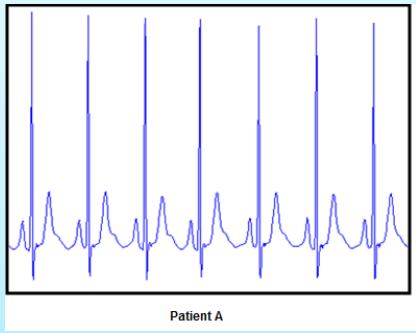
Cross-Directorate Program: CISE, ENG, and SBE

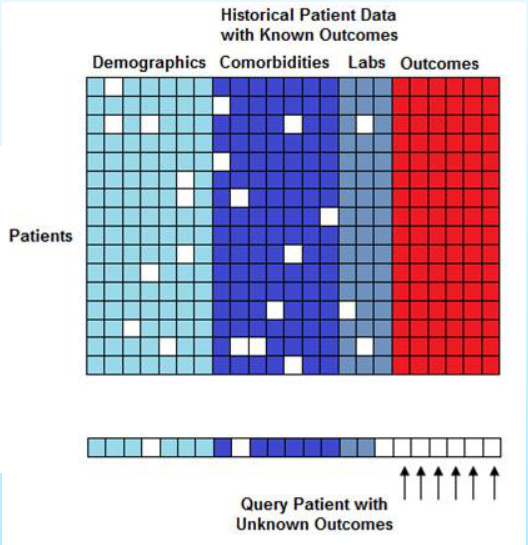
Smart Health & Wellbeing



Improving Device Safety:
In cooperation with FDA, NSF projects are underway to design, validate, and accelerate certification of medical devices.
(University of Illinois, University of Pennsylvania, Harvard Medical/Mass General, University of Maryland, Kansas State University)

Predicting Risk of Cardiovascular Death:
Applying data mining and machine learning techniques to EKGs have identified new "computational biomarkers," which determine heart abnormalities and defects, leading to significant improvement in identifying and treating at-risk patients. (Zeeshan Syed, University of Michigan and John Guttag, MIT)





Enhancing Access to the Radio Spectrum (EARS)

Enhancing access to wireless service and/or efficiency with which radio spectrum is used

Credit: Nicolle Rager Fuller, National Science Foundation

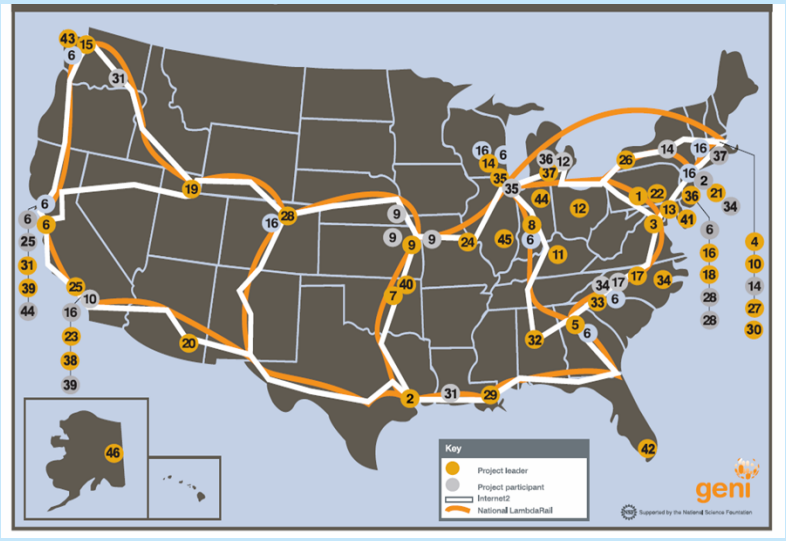
- Partnership among CISE, ENG, MPS, and SBE to strengthen U.S. leadership in the global wireless technology marketplace
- Support for research in wireless communication, spectrum sharing, and mobile computing, as well as development of wireless and spectrum testbeds
- Advance spectrum sensing techniques, explore machine learning and game theory for dynamic spectrum management, and understand incentive mechanisms

Mid-scale Research Infrastructure

Advancing networking, distributed systems, cloud computing and cybersecurity research through experimentation at scale

- **Global Environment for Networking Innovations (GENI)**
  - A virtual laboratory for exploring future internets at- scale, now taking shape in prototype form across the U.S.

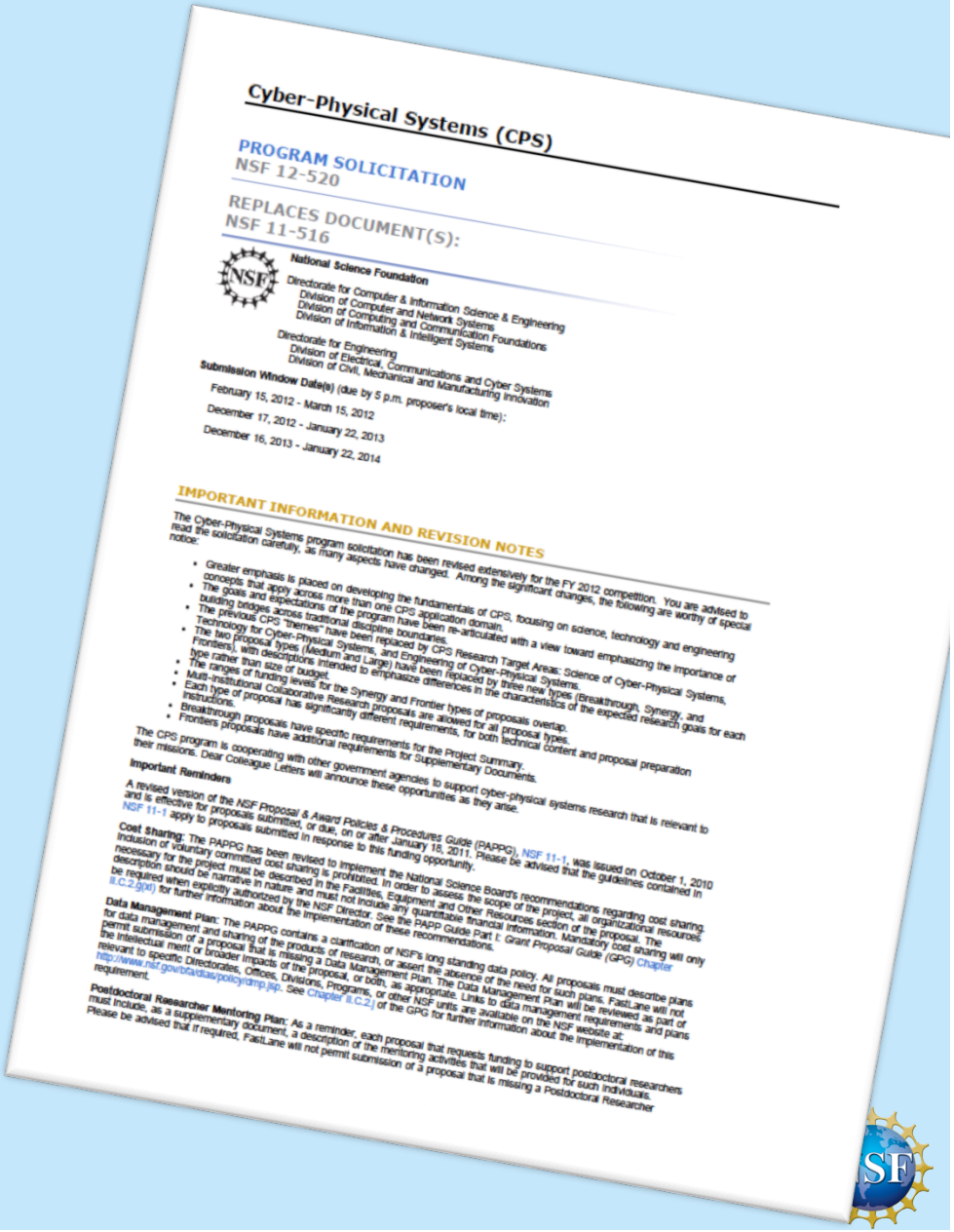
- **US Ignite**
  - Expand the GENI network, integrating more campuses, testbeds, regional and backbone networks, and stitching together “islands of broadband”
  - Enable foundational wired and wireless research at scale and jumpstart gigabit application development in areas of national priority



Activities Update

Recent CISE Solicitations

- Big Data (NSF-12-499)
- CE 21 (NSF 12-527)
- CPS (NSF 12-520)
- I/UCRC (NSF 12-516)
- SaTC (NSF 12-503)
- Smart Health and Wellbeing (NSF 12-512)
- CISE-MPS Interdisciplinary Faculty Program in Quantum Information Science (NSF 12-540)
- EARS (NSF 12-546)
- IGERT-CIF21 (NSF 12-555)
- Failure Resistant Systems (NSF 12-556)
- Grant Opportunities for Academic Liaison with Industry, GOALI (NSF 12-513)



Cyber-Physical Systems (CPS)

PROGRAM SOLICITATION
NSF 12-520

REPLACES DOCUMENT(S):
NSF 11-516

National Science Foundation

Directorate for Computer & Information Science & Engineering
Division of Computer and Network Systems
Division of Computing and Communication Foundations
Division of Information & Intelligent Systems

Directorate for Engineering
Division of Electrical, Communications and Cyber Systems
Division of Civil, Mechanical and Manufacturing Innovation

Submission Window Date(s) (due by 5 p.m. proposer's local time):

February 15, 2012 - March 15, 2012

December 17, 2012 - January 22, 2013

December 16, 2013 - January 22, 2014

IMPORTANT INFORMATION AND REVISION NOTES

The Cyber-Physical Systems program solicitation has been revised extensively for the FY 2012 competition. You are advised to read the solicitation carefully, as many aspects have changed. Among the significant changes, the following are worthy of special notice:

- Greater emphasis is placed on developing the fundamentals of CPS, focusing on science, technology and engineering concepts that apply across more than one CPS application domain.
- The goals and expectations of the program have been re-articulated with a view toward emphasizing the importance of building bridges across traditional discipline boundaries.
- The previous CPS "themes" have been replaced by CPS Research Target Areas: Science of Cyber-Physical Systems, Technology for Cyber-Physical Systems, and Engineering of Cyber-Physical Systems.
- The two proposal types (Medium and Large) have been replaced by three new types (Breakthrough, Synergy, and Frontiers), with descriptions intended to emphasize differences in the characteristics of the expected research goals for each type rather than size of budget.
- The ranges of funding levels for the Synergy and Frontier types of proposals overlap.
- Multi-institutional Collaborative Research proposals are allowed for all proposal types.
- Each type of proposal has significantly different requirements, for both technical content and proposal preparation instructions.
- Breakthrough proposals have specific requirements for the Project Summary.
- Frontiers proposals have additional requirements for Supplementary Documents.

The CPS program is cooperating with other government agencies to support cyber-physical systems research that is relevant to their missions. Dear Colleague Letters will announce these opportunities as they arise.

Important Reminders

A revised version of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), NSF 11-1, was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in NSF 11-1 apply to proposals submitted in response to this funding opportunity.

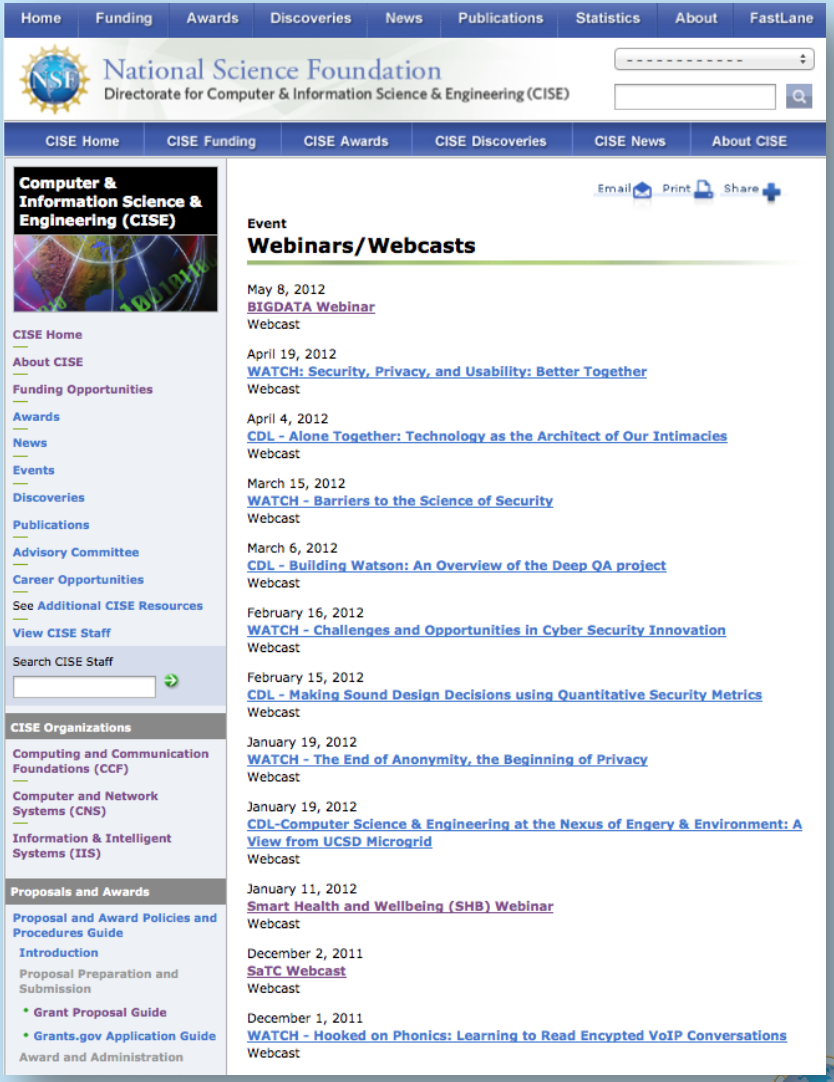
Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantitative financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: *Grant Proposal Guide* (GPG) Chapter II.C.2.j(xi) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/dmp.jsp. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher

Webinars for the CISE Community

- SEES – 400+ participants
  - Oct 11 & Oct 14, 2011
- SaTC –150+ participants
  - Dec 2, 2011
- SHB – 250+ participants
  - Jan 11, 2012
- Big Data – 400+ participants
  - May 8, 2012



CISE Community Outreach

November 2011 – May 2012

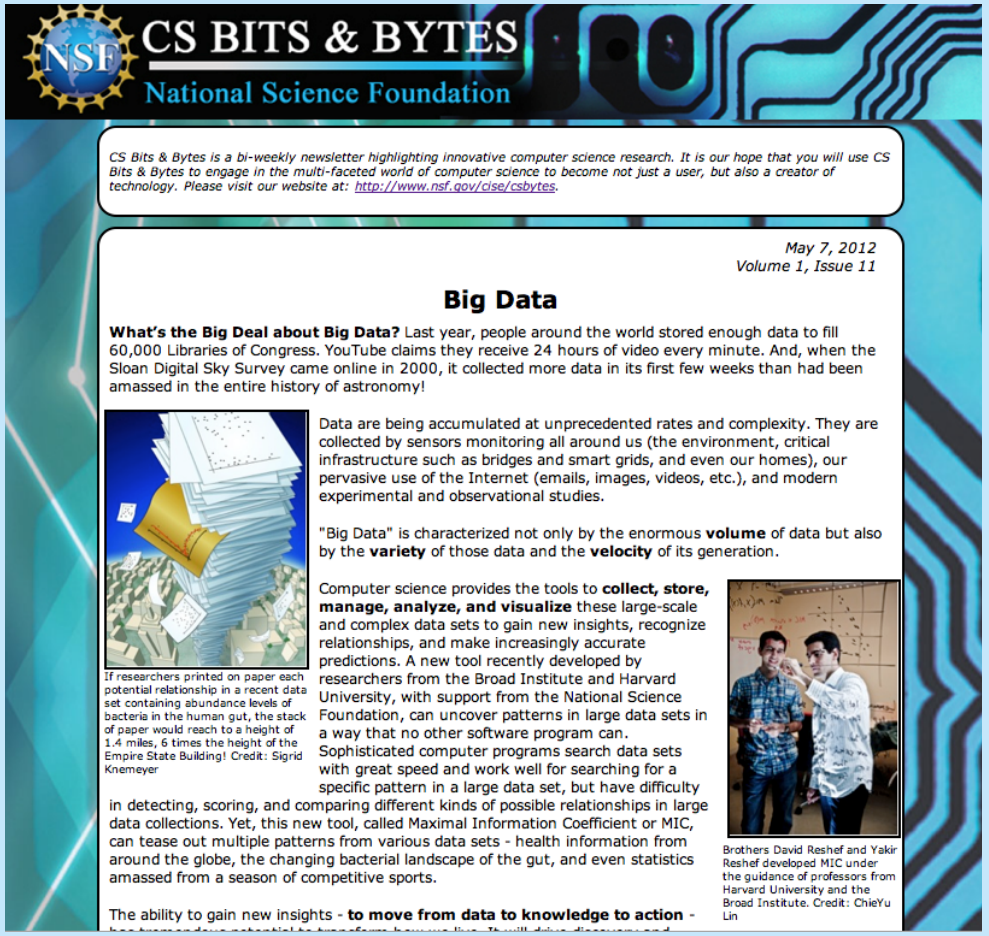
19 NSF workshops since Nov:

- "BoF" sponsored by CCF at VMCAI/POPL/VSTTE, Jan 2012
- RSV sponsored by CCF for Expeditions in Computing project "Understanding Climate Change: A Data Driven Approach," Jan 2012
- "Emerging Technologies for Interconnects" sponsored by CCF, Feb 2012
- "Forum on Integrated Sensors for Cybersystems" sponsored by NSF, SRC and Irish Science Foundation, Mar 2012
- "CISE Career Proposal Writing Workshop" sponsored by CISE, Mar 2012
- "Workshop on Cross-Layer Power Optimization and Management" sponsored by CCF, Feb 2012
- "Workshop on Social Networks and Mobility in the Cloud" sponsored by NSF, Google, Microsoft NEC, Qatar Computing Research Institute and Yahoo!, Feb 2012
- "Discovery Informatics Workshop" sponsored by IIS, Feb 2012
- "Cyberlearning Research Summit" sponsored by IIS, Jan 2012
- "ANR-NSF Workshop in Computational Neuroscience" sponsored by IIS and French National Research Agency, Nov 2011
- "Workshop on Patient Empowerment: A Transdisciplinary Informatics-Based Approach" sponsored by IIS, Nov-Dec 2011
- "Measuring Data for Population Health" sponsored by IIS, Jan 2012
- "Big Data Benchmarking" sponsored by IIS, May 2012
- "Strategic Workshop on Information Retrieval" sponsored by IIS, Feb 2012
- "CE21 PI meeting" sponsored by CNS, Feb 2012
- CCC "Visioning Workshop on Computing for Disaster Management" sponsored by CISE, April 2012
- "Security for Cloud Computing Workshop" sponsored by CNS, March 2012
- "GEC13" sponsored by CNS, Mar 2012
- "SEES Symposium" sponsored by NSF, Apr 2012
- CISE also supported student travel to IEEE Symposium on Security and Privacy, PerCom, 10th USENIX FAST, INCISE2, NSCI, CMU Electricity Conference on Data-Driven Systems, IISWC, INFOCOM, N2Women and IEEE Distributed Computing Systems

CS Bits & Bytes

Highlighting innovative computer science research

- Biweekly electronic newsletter
- Aimed at high school teachers and students
- Launched Dec 5, 2011 in celebration of CS Ed Week
- 11 issues to date
- Over 900 email subscribers and 18,000 webpage hits



CS BITS & BYTES

National Science Foundation

CS Bits & Bytes is a bi-weekly newsletter highlighting innovative computer science research. It is our hope that you will use CS Bits & Bytes to engage in the multi-faceted world of computer science to become not just a user, but also a creator of technology. Please visit our website at: http://www.nsf.gov/cise/csbytes.

May 7, 2012
Volume 1, Issue 11

Big Data

What's the Big Deal about Big Data? Last year, people around the world stored enough data to fill 60,000 Libraries of Congress. YouTube claims they receive 24 hours of video every minute. And, when the Sloan Digital Sky Survey came online in 2000, it collected more data in its first few weeks than had been amassed in the entire history of astronomy!

If researchers printed on paper each potential relationship in a recent data set containing abundance levels of bacteria in the human gut, the stack of paper would reach to a height of 1.4 miles, 6 times the height of the Empire State Building! Credit: Sigrid Knemeyer

Data are being accumulated at unprecedented rates and complexity. They are collected by sensors monitoring all around us (the environment, critical infrastructure such as bridges and smart grids, and even our homes), our pervasive use of the Internet (emails, images, videos, etc.), and modern experimental and observational studies.

"Big Data" is characterized not only by the enormous **volume** of data but also by the **variety** of those data and the **velocity** of its generation.

Computer science provides the tools to **collect, store, manage, analyze, and visualize** these large-scale and complex data sets to gain new insights, recognize relationships, and make increasingly accurate predictions. A new tool recently developed by researchers from the Broad Institute and Harvard University, with support from the National Science Foundation, can uncover patterns in large data sets in a way that no other software program can. Sophisticated computer programs search data sets with great speed and work well for searching for a specific pattern in a large data set, but have difficulty in detecting, scoring, and comparing different kinds of possible relationships in large data collections. Yet, this new tool, called Maximal Information Coefficient or MIC, can tease out multiple patterns from various data sets - health information from around the globe, the changing bacterial landscape of the gut, and even statistics amassed from a season of competitive sports.

Brothers David Reshef and Yakir Reshef developed MIC under the guidance of professors from Harvard University and the Broad Institute. Credit: ChieYu Lin

The ability to gain new insights - **to move from data to knowledge to action** -

http://www.nsf.gov/cise/csbytes/

Washington Area Trustworthy Computing Hour (WATCH) Seminar Series

- **Past WATCH seminars:**
  - 4/19/12 – Lorrie Cranor, “Security, Privacy, and Usability: Better Together”
  - 3/15/12 - Tom Longstaff, "Barriers to the.Science of Security"
  - 2/16/12 - Paul Barford, "Challenges and Opportunities in Cyber Security Innovation"
  - 1/19/11 - Vitaly Shmatikov, "The End of Anonymity, the Beginning of Privacy"
  - 12/1/11 - Fabian Monrose, "Hooked On Phonics: Learning to Read Encrypted

Each webcast attracts approximately 30 viewers

FY12 NSF DISTINGUISHED LECTURE SERIES
IN COMPUTER INFORMATION SCIENCE & ENGINEERING

Thursday, October 13, 3:30pm (Rm. 110)
Prof. Lydia Kavraki, Rice University

Motion Planning for Physical Systems

Tuesday, November 8, 1:30pm (Rm. 375)
Prof. Daniel Spielman, Yale University

Algorithms, Graph Theory, and Laplacian Linear Equations

Thursday, January 19, 10am (Rm. 110)
Prof. Rajesh Gupta , UC San Diego

CS&E at the Nexus of Energy & Environment: A View from UCSD Microgrid

Wednesday, February 15, 10am (Rm. 110)
Prof. William Sanders, UIUC

Making Sound Design Decisions using Quantitative Security Metrics

Tuesday, March 6, 2pm (Rm. 110)
Dr. David Ferrucci, IBM

Building Watson: An Overview of the DeepQA Project

Wednesday, April 4, 2pm (Rm. 110)
Prof. Sherry Turkle, MIT

Alone Together: Technology as the Architect of Our Intimacies

Talks held at 4201 Wilson Blvd, Arlington, VA 22230

Questions: Contact Dawn Patterson at dpatters@nsf.gov

NCWIT: A NATIONAL RESOURCE FOR DIVERSITY IN COMPUTING EDUCATION AND THE TECHNOLOGY WORKFORCE

The National Center for Women & Information Technology (NCWIT)

Increasing Diversity in IT and Computing

NCWIT believes that greater diversity will create a larger and more competitive workforce, and promote the design of technology that is as broad and innovative as the population it serves. NCWIT focuses on the entire spectrum: K-12 through college education, and on to academic and entrepreneurial careers.

Learn about NCWIT's strategies, programs, and RESULTS!

Join CISE in welcoming NCWIT for a short presentation followed by a poster session.

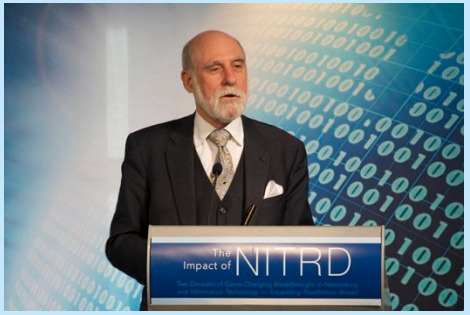
DATE: Wednesday, February 1, 2012
TIME: 9:00 – 10:45 AM
PLACE: NSF Stafford I, Atrium
CONTACT: Jan Cuny, jcuny@nsf.gov

NITRD 20th Anniversary Symposium

- Feb 16, 2012 at the Newseum
- Organized by CCC in collaboration with NCO
- Agenda highlights:
  - IT and People (Kevin Knight, Elizabeth Mynatt, Helen Nissenbaum)
  - IT in the Physical World (Sebastian Thrun, Shwetak Patel)
  - Economic Impact of NITRD (Erik Brynjolfsson, Tom Lange)
  - Building Blocks of IT (Vint Cerf, William Scherlis, and Stefan Savage)
  - IT for the Advancement of Science (Russ Altman, David Keyes, Katherine Yelick)
  - IT and the World of Data (Eric Brown, Eric Horvitz, Alexander Szalay)
  - Future “Big Ideas” Panel (Tom Kalil, Peter Lee, Elizabeth Mynatt, Stefan Savage, Charles Vest)
  - Farnam Jahanian, George Strawn, Jeanette Wing, Ed Lazowska, Susan Graham
  - Former VP, Al Gore
  - Honorable Tom Davis, formerly U.S. House of Representatives (VA)

NITRD 20th Anniversary Symposium

The webcast and presentations are available online.
Visit: http://www.nitrd.gov/nitrdsymposium/index.aspx



Images Courtesy of *CCC*

NSF Activities Update

- Global Merit Review Summit
  - On May 14-15, heads of research councils from G-20 and OECD countries will gather at NSF to identify common principles and facilitate collaboration

- NSF Communications Task Force
  - Surveyed Advisory Committee members and NSF panelists
  - Developed recommendations with input from focus groups
  - Recommendations under review by OD

- New NSF Senior Management
  - Judith Gan, Head, OLPA
  - Gene Hubbard, Chief Human Capital Officer, OIRM

Updates from the NSB

- Task Force on Merit Review
  - "National Science Foundation's Merit Review Criteria: Review and Revisions" released January 10, 2012
- Task Force on Unsolicited Mid-Scale Research
  - Final Report in preparation
- S&E Indicators released January 18, 2012
  - "US remains the global leader in supporting S&T R&D, but only by a slim margin that could soon be overtaken by rapidly increasing Asian investments in knowledge-intensive economies"
  - http://www.nsf.gov/statistics/seind12/

Exploring the Frontiers of Computing and Communication

- Our investments in **research and education** have returned exceptional dividends to our nation

- A thriving basic research community is the foundation for long-term **discovery** and **innovation**, **economic prosperity**, and **national security**

- As a field of inquiry, computer, communication and information science and engineering has a **rich intellectual agenda** – highly creative, highly interactive, with enormous possibilities for changing the world

Thanks!

fjahania@nsf.gov

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